An Overview on Knowledge Management

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Abstract This first chapter has to be considered like a general entry in the problematic of Knowledge Life-Cycle Management. Some general issues are addressed. First a literature review is proposed that is supposed to highlight the domain and the corresponding concepts and aims through definitions. Knowledge Life-Cycle (KLC) is more especially considered and the strategic dimensions of KLC are described and commented. Then Knowledge Management is positioned with respect to information technology. A conclusion paragraph closes the paper.

Keywords: Knowledge Management; Knowledge Life-Cycle

1 Introduction

The capacity of innovation and the performance of activities become currently a major stake for the success of companies. Companies act today more than ever in a very competing environment. Thus, to play an important role in the global market, it is necessary to combine, more than before, satisfaction of the customers, productivity and competitiveness. One has also to face the growth of technology with a significant increase in the volume of available and accessible information. This information being diversified, delocalized and not easily controllable led to the development of many information systems management tools to exploit it as well as possible [34].

Currently, this information is processed and managed by taking into account its meaning and its semantic, this means that we manage knowledge. Knowledge is regarded nowadays as a strategic resource and a factor of stability, bringing a decisive competing advantage.

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Knowledge management (KM) is necessary to the company to innovate on products, processes, services and on the organization. It allows at the same time to reduce its design costs, production, distribution, etc. Managing knowledge is not a new problem. The difference with the past is that currently companies attack this problem explicitly according to a conscious approach, controlled and voluntary. This was done in the past without thinking of it [24].

KM as a discipline appeared in response to a vast range of problems resulting from losses of memory due to the departures in retirement, development of technologies, and innovation. It is seen as a procedure that requires specific approaches with the aim of increasing the added value of design and production processes. Each Company's strategy is different, but all tend to maximize the profits, to improve the image of the company and to occupy a dominating place on the market. However, setting up a KM including all the activities of a company, increases its spending of time and costs in an exponential way.

The Knowledge management problem is a complex one. It relates to capitalization (long and hard mission: bearing of the teams, personnel retirement, training new recruits), re-use, management and project accompaniment, cooperative work and experience feedback [24]. From case to case, it is a question of learning from the past (to capitalize), learning from the present (project accompaniment, to organize), anticipating the future (to create, innovate) and reducing the costs and the deadlines. And still to more ensure the survival of the company in a strongly competing environment. Several concepts and definitions have been associated to knowledge management. Next sections introduce them.

2 Literature Review

The need for knowledge management has increased as a result of the rapid changes in the business environment today. First, applications of customization require knowledge on diverse customer needs and preferences. Second, multiplicity of end applications of technology and acceleration of technical change requires KM, which includes codification, personalization and knowledge process controls. Third, the growing diversity of knowledge sources from greater use of outsourcing and deconstruction of the value-chain requires management of these increased sources [11].

Knowledge management has received widespread attention in recent years. Companies and academics have highlighted the importance of knowledge as the basis for competitive advantage [4, 30, 34], while a vast body of literature has been generated around the creation and exploitation of knowledge in organizations. We begin this section with an overview of the knowledge management definitions as it relates to incentive structures, followed by an introduction of its related concepts.

2.1 Definitions

Though there is general agreement and acceptance of the importance and relevance of knowledge and KM. There exist a number of perceptions and definitions of knowledge and KM. Before proceeding further, it is necessary to define them:

- Knowledge is a whole set of intuition, reasoning, insights, experiences related to customers, products, processes, markets, competition and so on that enables effective action.
- Knowledge Management is a systematic, organized, explicit and deliberate ongoing process of creating, disseminating, applying, renewing and updating the knowledge for achieving organizational objectives.

Starting from this definition, KM can be considered as a business activity with two primary aspects:

- Treating the knowledge component of business activities as an explicit concern of business reflected in strategy, policy and practice at all levels of the organization;
- Making a direct connection between an organization's intellectual assets – both explicit and tacit – and growth [2].

Considering these two aspects, KM "in practice often encompasses identifying and mapping intellectual assets within the organization, generating new knowledge for competitive advantage within the organization, making vast amounts of corporate information accessible, sharing of best practices, and technology that enables all of the above – including group-ware and intranets" [2].

> KM has also been more concisely defined as "the leveraging of collective wisdom to increase responsiveness and innovation," [20]. While others have represented it as: "… the process by which the organization generates wealth from its intellectual or knowledge-based assets" [8]. Dan Holtshouse, Xerox's Director of business strategy and knowledge initiatives, writes in the forward to Information Technology for Knowledge Management, Berlin Springer-Verlag 1998; that KM "… is about creating a thriving work and learning environment that fosters the continuous creation, aggregation, and use/reuse of both organizational and personal knowledge in the pursuit of new business value."

The usefulness of these definitions is not that they describe KM and establish its purpose but that they illuminate four principles which management must be cognizant of when considering how to manage knowledge for competitive advantage. The KM common implications to these definitions are:

- Knowledge is connected. It is collective wisdom that exists in experiences and perspectives, it's usefulness is derived from its contextual relationships and attributes surrounding its content;
- Knowledge is applicable in new environments. Information applied to address a novel situation for which no precedent exists results in new knowledge, competitive action and growth;

- KM is a catalyst. It is an action. Knowledge is always relevant to environmental conditions and stimulates action in response to these conditions; and
- KM solutions are dependent on a knowledge sharing culture [20].

Despite differences in diction, these definitions let the concept of KM being operational and communicate the role of knowledge as a necessary constituent for business activities and organizational competitiveness. Furthermore, these KM thinkers have established the framework to conduct an intelligent discussion on the distinction between KM and information management (IM).

2.2 What is Managed in Knowledge Management?

KM emerged several years ago just when managers and organizations had finally become comfortable with IM (Information Management). At that time managers perceived that this new "business fad" was nothing more than terminology inflation, dignifying IM with the term knowledge, [14]. In some respects the sceptics are correct, as there is a large amount of IM in KM; however, true KM moves beyond IM in several ways.

2.2.1 Relationship Between Data, Information and Knowledge

Within different fields of research many authors have developed definitions for data, information and knowledge [3, 15, 31, 33], these definitions have been reviewed extensively by Court [12] within the context of engineering design.

Court concludes that information is comprised of a number of data parts and of their descriptions, and that knowledge is the ability of an individual to understand information and to describe the manner in which it handles, applies and uses it in a given situation. This corresponds with work in the management sector, which defines knowledge as information within people's minds [13].

Combined with the fact that data, information and knowledge are often considered to be synonyms of one another severely frustrate the ability to identify information or knowledge, and develop requirements for their capture. The authors consider that whilst each is related there are differences between them, and these differences hold the key to better enabling their effective identification, capture and reuse of these resources. The following paragraphs define each resource as well as describing their relations within the context of engineering design.

- **Data**
  Data is usually considered to be textual, either numeric or alphabetical (http://dictionary.cambridge.org, 2001). Some authors distinguish structured data from unstructured ones, however, it is arguable that any representation of data is structured, whether it is computer information stored in a file or a stack of paper based documents, these are both indirectly structured or ordered.

- **Information**
  A number of authors provide discussions on the definition of information, often with respect to data. These discussions led to a definition of an information element as 'describing a fact', where the fact is an occurrence of a measure or inference of some quantity or quality. The fact does not have to be true and fair, it may be subjective or objective. Thus, information can be defined as being what data becomes when humans interpret it and contextualize it. It is also the carrier we use to express and communicate knowledge in business. Information has more value than data and is more ambiguous. This is evident from the litany of predictions economists produce from the same economic information. Some authors differentiate the information in two classes: formal and informal.
  - Formal information is an element of information that provides a specific context and measure. It provides a structure or a focus so that individuals exposed to it may infer the same knowledge from it, such as formal education, where the content and order is prescribed. In order to achieve this, formal education is structured and sufficiently decomposed to describe all the necessary information, which includes facts and relations, upon which the inferred knowledge is based.
  - Informal information is considered by the authors to encompass unstructured information. The majority of which is either personal information or information that is developed through interaction between two or more individuals. Here the subjects and predicates may not be clearly defined; the information may change dynamically as content is altered or added. Indeed this varied and dynamic information set provides for the generation of various knowledge perspectives for the individuals taking part, and it is this variation that both stimulates and develops the creative and decision-making processes.
- **Knowledge**
  Knowledge is information within people's minds and is valuable as new ideas; insights and interpretations can be applied to information in an effort to generate competitive power and value. From a management perspective, employees' knowledge is difficult to administer, as it is intangible, therefore stimulating its flow for sharing, use/re-use and capturing it in a corporate memory relies on human motivation, an individual's ability to articulate their knowledge and apply it.

Despites these separated definitions, in practice, it is difficult to determine when data becomes information and when information becomes knowledge. For practical purposes managers can consider data, information and knowledge, points along a continuum of increasing value and human contribution [14]. Davenport and Marchand [13] and Stewart [29], advocate that managers spend little energy on this debate and a lot of energy on adding value to what they have by advancing it along the continuum [29].

2.2.2 Enhanced Information Management

The rationale for the link between IM and KM is derived from the fact that employees in organizations are constantly transforming knowledge into various forms of information such as memos, e-mails, manuals and reports while they acquire information from others to improve their knowledge. This perpetual regeneration of knowledge into information and information into knowledge is necessary, as people are not always able to share their own knowledge with others due to constraints such as time, the number of people to be informed and geographical location differences. Therefore, KM improves IM by developing easily accessible repositories of information about knowledge. This information guides the employee to the required source of knowledge, whether a document or an expert. Such corporate knowledge maps or expertise directories "… describe a set of knowledge categories, the location of the knowledge and, in some cases, its condition and value" [13]. Bukowitz and Williams [8], Davenport and Marchand [13], Davenport and Prusak [14], Nonaka and Takeuchi [25], Stewart [29] and Koulopoulos and Frappaolo [20] all espouse that the most important knowledge is in people's heads and that the human mind is the primary repository of knowledge; consequently, facilitating access to it through improved IM via knowledge cartography and employee profiling is an important part of KM.

In addition, as an organisation exists to achieve specific goals and objectives, their members are encouraged to share their knowledge. KM promotes this through enhanced IM regarding where knowledge resides and its use/reuse. What this means is that KM depends less on the amount of information than on the number of connections that link employee to knowledge and employee to information. This dynamic distinction between KM and IM is a critical distinguishing feature reflecting on the connected aspect of knowledge.

2.2.3 Knowledge Application

The other challenging aspect of KM that differentiates it from IM relates to the way employees apply and use knowledge in contrast to information. Knowledge, like information, is of no value to business unless applied to decisions that result in competitive action. Plugging information into a previously encountered situation is not the application of knowledge for competitive advantage, as this is easily imitated. This implies that populating electronic and paper-based corporate repositories with information on knowledge is not knowledge management but the intermediate storage of information en-route among employees' heads [20]. KM is not created unless attention is paid to how employees apply and use their knowledge for generating new ideas for future business [13].

Comprehending this difference is essential for understanding KM as "information management consists of pre-planned responses to anticipated stimuli while KM embodies unplanned responses to surprise stimuli" [20]. The significance of this stimulus/response aspect is that knowledge must be internalized to be functional as opposed to information. It must co-exist with human aptitude in order to make intelligent decisions. Successful knowledge internalization should result in actions that reflect a change in human behavior. The way knowledge is applied and stored in the human mind is a critical difference between KM and IM, one which managers must fully appreciate in order to implement an effective KM initiative. If an organization's KM initiative is limited to better IM or application of the latest IT without consideration for how knowledge is applied, growth may be limited as the exploitation of collective knowledge to innovate and grow the business is unlikely [13].

Knowledge creation, application and its use are complex issues determined by corporate culture, reward schemes, structure, strategy, skills, staff, management style, values and the design of processes for knowledge work. The continuous conversion of knowledge into information and information into knowledge is a key element of what companies must do to develop and apply knowledge successfully. There is no doubt that KM incorporates both IM and the use of IT to acquire and map information on knowledge and connect employees to knowledge. However, "if knowledge resides primarily in people and it is people who decide to create, use and share their ideas to attain business results, then KM is as much about managing people as it is about managing information and IT" [13].

2.3 Knowledge Life-Cycle

Information is converted into knowledge through a human social process of shared understanding and sense making at both the personal level and the organizational level. Nonaka and Takeuchi [25] refer to this flow as the "Knowledge Life-Cycle" (see Figure next page) and it hinges on the distinction between tacit knowledge and explicit knowledge. Explicit knowledge is formal knowledge that has been captured by the corporate memory. It defines the intellectual assets of an organization independently of its employees, thus it is structural knowledge [29]. Tacit knowledge is practical knowledge, know how that produces action, it's the key to getting things done. It has an important cognitive dimension, consisting of "… mental models, beliefs, and perspectives so ingrained that we take them for granted, and therefore cannot easily articulate them" [25]. Tacit knowledge is personal knowledge that is difficult to formulate, measure or value; consequently, management has ignored it in the past. The recent management interest in tacit knowledge can be explained by the fact that it's deeply rooted in action and individual commitment to specific context [25].

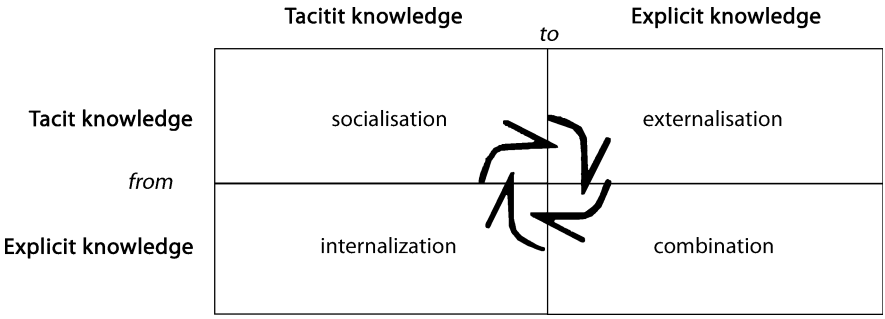

Fig. 1 Knowledge conversion (adapted from Nonaka and Takeuchi 1995)

2.3.1 Knowledge Flow

KM that results in action depends on taping the tacit knowledge and subjective insights, intuitions and hunches of individual employees and making these available for testing and use by the whole organization, [5, 7, 8, 14, 27]. The combining of tacit and explicit knowledge improves the use and reuse of current knowledge by developing best practices and creating new knowledge through the revision and destruction of existing knowledge. This flowing of knowledge, according to Carneiro [9] and Argyis [1], can result in innovative actions that produce competitive advantage.

The crux of the "Knowledge Life-Cycle" as espoused by Borghoff and Pareschi [5] is that knowledge that does not flow does not grow and eventually becomes obsolete. Powerful KM applications will have no value without willing participants who originate a flow of knowledge; network critical mass is essential for successful KM. This is just not a matter of installing effective IT but nurturing a knowledge sharing culture. Davenport and Prusak [14] argue that building communities of interest is an effectual technique for achieving critical mass. Often management just has to identify and support these informal "self organizing groups numbering around 50 to 300 people in large companies, sharing common work interests and passions, usually cutting across a companies functions and processes" [14]. Such groups embody a knowledge sharing culture, resulting in a functional knowledge life cycle where knowledge is converted from tacit to explicit to tacit again on a continuous basis.

"Existing tacit knowledge can be expanded through its socialization in communities of interest and practice and new tacit knowledge can be generated through the internalization of explicit knowledge by learning and training. New explicit knowledge can be generated through the externalization of tacit knowledge, as happens, for instance, when new best practices are selected among the informal work practices of an organization. Existing explicit knowledge can be combined to support problem solving and decision-making, for instance by matching intellectual capital in the form of patents with marketing data showing customers preferences for new products" [5].

2.3.2 Effective Knowledge Application

If the primary role of KM is to stimulate the flow of knowledge throughout the organization, then how is this behavior to be achieved in such a way that individuals and groups understand the knowledge and its context so as to apply it effectively and Strauss [23] suggest that taping tacit knowledge and stimulating its flow is possible through a managed process they call "Creative Abrasion". The centerpiece of "Creative Abrasion" is a recruiting and selection policy that is deliberately designed to staff the organization with a full spectrum of cognitive and communication styles. Such a human resource (HR) policy can result in a whole brain organization where the voicing of different perspectives and opinions enhances problem solving. Nonaka [25] agrees with the concept of creative abrasion but goes further, espousing a model he refers to as the "Spiral of Knowledge". According to Nonaka, making tacit knowledge available to others is the central activity of the knowledge creating company. He contends that this is possible through the disciplined and systematic use of metaphors, analogies and models to convert tacit knowledge to explicit knowledge.

This use of figurative language and models to create new knowledge and express what seems inexpressible is routinely used by organizations such as Xerox, which used a beer can analogy to invent the photo-copier drum and Honda, which used the slogan "the theory of automobile evolution" to design the successful Honda Civic.

The pre-eminent organizational theorist, Chris Argyris [1], believes that the successful articulation of tacit knowledge and the creation of new knowledge depends on the ability to escape "Single Loop Learning" and deploy "Double Loop Learning" at the individual and organizational level. An example of "Single Loop Learning" is the use of a particular tool to perform a repetitive function that quickly wears the tool out, resulting in the technician replacing the tool. If "Double Loop Learning" were applied the technician would ask, "why does this function have to be performed?" or "why does this particular design of tool have to be used?" and then explore whether or not the activity could be eliminated or if some other more robust tool could be used economically. Argyris espouses that "Double Loop Learning" moves beyond "Single Loop Learning", which is premised on preplanned responses to anticipated stimuli, by questioning the appropriateness of preplanned actions. Argyris challenges the common assumption that getting employees to learn and share knowledge is a matter of motivation alone and that when people have the right attitude and commitment learning and sharing automatically follows. He contends that incentive schemes and organizational structures designed to create commitment and motivation don't affect employees' cognitive programming. Effective "Double Loop Learning" is a reflection of how employees and managers think "… that is the cognitive rules or reasoning they use to design and implement their actions" [1]. This cognitive programming is the aggregate of a lifetime of experiences, environmental influences and education.

The first step towards "Double Loop Learning" is to teach senior managers how to reason about their behavior in more productive and effective ways. Argyris argues that any educational program designed for managers should be connected

to real business issues. He offers one simple approach, having participants produce a case study concerning a current business issue they are facing. The case becomes the focal point of a group analysis and discussion that results in the questioning of all taken for granted assumptions. In effect the case study exercise legitimizes the discussion of issues that have not been addressed before. "Double Loop Learning" requires employees to question the relevance of past experience and its appropriateness in current and future situations. It means learning that produces radical behavior changes in the value chain, resulting in innovative actions and processes that increase competitiveness. Efforts at double loop learning should be augmented with Leonard and Strauss's "Creative Abrasion" and Nonaka and Takeuchi's "Spiral of Knowledge" as diverse views, figurative language and models of concepts facilitate the social process of articulating tacit knowledge into public information, permitting its internalization.

2.3.3 Knowledge Market

Davenport and Prusak [14] argue that the above management prescriptions are necessary but on their own are not sufficient to stimulate the flow of tacit knowledge or produce effective application of knowledge. They believe that market forces power tacit knowledge movement, working similarly to markets for more tangible goods. Like markets for goods and services, the knowledge market has buyers and sellers who negotiate to reach a mutually satisfactory price for the knowledge transaction. Employees search for knowledge because they expect it to help them succeed in their work as knowledge is the most sought after remedy to uncertainty.

The knowledge market, like any other is a system in which participants exchange a scarce unit for present or future value. From economic perspective knowledge market transactions occur because all the participants believe they will maximize their utility from them.

Many KM initiatives have been based on the naive assumption that knowledge flows without friction or economic motives, "… that people will share knowledge with no concern for what they may gain or lose by doing so" [14]. Organizations install IT expecting knowledge to flow freely trough the electronic network and blame the technology, employee skills or employee attitudes when the knowledge does not flow. Such an outcome is predictable as "… knowledge initiatives that ignore the dynamics of markets (and, of course human nature) are doomed to fail" [14]. Davenport and Prusak and Stewart [29], believe that to have a knowledge market that works well management must understand three market realities:

- Knowledge is a commodity and market forces exist for it;
- Market failures exist and must be captured in order to transform knowledge into corporate value; and
- Try to understand how knowledge markets operate.

The implication that knowledge markets exist indicates the apparent need to link the KM initiative to the organizations' incentive scheme by converting in

money the value of proactive participation. In their research Davenport and Prusak [14], have found that organizations get what they pay for. Short-term trinkets such as frequent flyer miles may motivate a single transaction of a KM system but will not establish the consistent culture of knowledge sharing. To institute a KM culture, organizations must use a valuable currency such as substantial monetary awards, salary increases, promotions and employment benefits as the primary lever for creating a knowledge-sharing culture, [Quinn, Anderson & Finkelstein 96]. In order for the KM system to add value it must achieve critical mass throughout the entire organization. Financial incentive is one method to achieve this but other non-financial motivating mechanisms, [20] must augment it.

A crucial activity in KM is the stimulation and transfer of knowledge that results in competitive action. However, according to the above cited thinkers this is dependent on organization structure, incentive scheme, staffing policy, the ability to articulate tacit knowledge and the motivation and commitment to participate in the KM initiative.

2.3.4 Structured Knowledge

Knowledge can be reduced to a basic level. At this level all employees can be aware of various facts and use data from sources such as contracts, annual reports, market data and production processes. Stewart [29] refers to this type of knowledge, which depreciates quickly, as "intellectual working capital, workaday information – the price of a stock, the name and phone number of XYZ Corp.'s purchasing executive, the number of gaskets in the warehouse, a nation's merchandise trade balance – changes all the time".

As requirements become more technical, knowledge tends to be specialized and contextually related to other knowledge. This semi-permanent body of specialized knowledge is intellectual capital according to Stewart and its value is derived from expertise and the application of knowledge to provide meaning and context to information and data. At this level, knowledge workers such as researchers, professional engineers, marketers, consultants, lawyers, librarians and accountants are able to offer insights into what Rittel [28] refers to as wicked problems. According to Rittel, wicked problems display a number of unique traits as follows:

- Cannot be easily defined;
- Require complex judgments to define problem;
- Have better or worse solutions; not right or wrong;
- Have no objective measure of success;
- Require trial and error process; and
- No alternative; solutions must be discovered.

The above paraphrase reveals the connection between wicked problems and the knowledge workers' specialized knowledge and capacity to produce innovative solutions. This connection and the difference between intellectual working capital

and intellectual capital justify the categorized structuring of knowledge and differentiation of knowledge domains. This is necessary because decision-making processes can become dysfunctional if all knowledge domains are considered similar resulting in an ineffective corporate knowledge repository. Research indicates that all "successful knowledge management projects benefit from some degree – though not much – of a knowledge structure," [14]. In one case Davenport and Prusak researched, a large professional services firm that attempted to create a wholly unstructured knowledge repository, searchable on all words in the database. It was virtually unusable, yielding too many or too few items and retrieving items that where not in context with the search terms. Firms building a knowledge repository or Intranet should consider creating knowledge categories within critical business processes and key search terms with a thesaurus to assist users [14].

2.3.5 Organizing Around Knowledge

When designing support schemes for knowledge work, management must evaluate the structure of the organization and its resource configuration. Organizational and KM thinkers like Argyris [1], Drucker [16], Stewart [29] all agree that designing organizational structure around learning, critical examination of past experience, openness and required knowledge for success provide the optimum environment for knowledge workers to perform. Such a learning structure has been described as "an organization skilled at creating, acquiring, and transferring knowledge and at modifying its behavior to reflect new knowledge and insights" [17].

The learning organization abandons hierarchical structures in an effort to increase responsiveness and organizes itself in patterns specifically tailored to support the particular way its knowledge workers create value, [27]. Such reorganization often involves breaking away from traditional thinking about the role of the centre as a directing mechanism. By organizing around the work of its value-adding employees management can achieve considerable leverage with the organization's resources and competencies by eliminating whole layers of management in the value chain. The reason is straightforward: "It turns out that whole layers of management neither make decisions nor lead. Instead, their main, if not their only, function is to serve as relays – human boosters for faint, unfocused signals that pass for communications in the traditional pre-information organization" [16].

Management in the learning organization functions as a support mechanism for the knowledge worker focusing individual employees on the joint performance of the organization, [16]. The function of management changes from issuing orders to removing barriers, expediting resources, conducting studies and acting as an internal consultant to the knowledge worker. Management's main role is to articulate and support the new corporate culture while the traditional departments serve as guardians of standards, providers of professional development and ensuring regulatory compliance. The main challenge facing management in the learning organization is to focus and discipline the creative process without stifling it [29].

2.3.6 Knowledge Management Culture

In short, knowledge workers' specialized skills and intellect directly influences an organization's competitiveness and therefore its growth. Considering their strategic objectives, organizations should define the level of knowledge and what type of knowledge will be more important to take care of. However, without being differentiated and stimulated, knowledge may stay in a static relation within functional areas, despite projects being performed by a multi-disciplinary team. Thus, if KM is charged with stimulating and supporting knowledge flows in an effort to promote growth, managers should develop the ability to identify critical knowledge, motivate knowledge workers, improve their understanding of knowledge work and improve their appreciation of how people relate to information.

From this social/cultural approach to the KM philosophy, KM can be explained as the management of the environment that makes knowledge flow through all the different phases of its life cycle [25]. Managing knowledge then begins with the importance of stressing people, their work practices and formal and informal corporate culture in order to differentiate knowledge and stimulate its flow, use/re-use and creation in the quest for growth.

3 Knowledge Management and Information Technology

Nonaka and Takeuchi's [25] theories are fundamental to knowledge management but they fail to recognize IT's role in enabling the flow of knowledge, capturing knowledge, combining knowledge and developing knowledge communities. The management of the IT infrastructure for KM is a critical success factor for an organization. Indeed in today's information driven society, much of an organization's environment is determined by its IT infrastructure.

As Brown [7], Drucker [16], Stewart [29] and Quinn, Anderson and Finkelstein [27] make clear, past KM and associated IT initiatives that have failed, are a result of several management misconceptions regarding knowledge work, business strategy and IT:

- **Management** often neglects to align technology and KM with corporate strategy. IT and KM are only worth investing in the context of strategy.
- Many **managers** have not accepted that knowledge work is fundamentally different in character from routine white-collar procedures resulting in the application of technology that does not fit knowledge work processes.
- **Traditional** organizational structure and human resources policy does not support the fact that knowledge work is cross-disciplinary and therefore knowledge work teams function in an ad hoc fashion and are completely immersed in a networked computing environment that is hindered by functional boundaries.
- Management has focused on capturing all organizational knowledge on corporate databases. This is both impractical and impossible.
- Too much KM is inward focused. Too little is about serving customer. Stewart believes this to be reflection of KM that is driven by HR or Information Systems.

Designing an effective IT information architecture to support a KM initiative is an important management challenge. Carneiro [9], Borghoff and Pareschi [5] and Botkin [6] espouse that it is necessary to pay attention to the IT architecture and implement it in accordance with the organizational functions that use knowledge and information to make decisions that realize objectives. They, along with Ward [32], advocate that IT systems must be comprehensive, highly integrated and that the electronic corporate memory must maximally contribute to the competitiveness of the organization. Furthermore, Borghoff and Pareschi [5] maintain that the KM IT architecture must improve competitive power by supporting three types of learning: individual learning, organizational learning through communication and continuous development of an electronic corporate knowledge repository.

During the industrial era organizations maintained their competitive advantage by keeping materials and processes secret. For the most part the technology and higher education levels of the new economy make it almost impossible to prevent competitors from copying or improving on a new product or new process fairly quickly. "… In an era characterized by mobility, the free flow of ideas, reverse engineering, and widely available technology" [14], sustainable competitive advantage from the possession of unique technology has disappeared as technology is now available to all organizations and its half-life has diminished. The advantage of new products and efficiencies are more and more difficult to sustain. To remain competitive in the dynamic and complex environment of the new economy Kotler [18] believes that every company should work hard to obsolete its own product line before competitors do. The key to this is continuous innovation.

According to Davenport and Prusak [14], knowledge by contrast to materials and processes can provide sustainable competitive advantage as it generates increasing returns and continuing advantage. Stewart [29] makes it clear that knowledge assets increase with use as ideas propagate ideas and sharing knowledge enriches the receiver. So what KM approaches are organizations pursuing to leverage the knowledge advantage? Koulopoulos and Frappaolo [20] point out three approaches that are not mutually exclusive, currently being undertaken by industry. Two of them are the following and will be commented in the following paragraphs:

- The learning organization;
- The knowledge library.

3.1 The Learning Organization

As discussed earlier the learning organization is concerned with enabling organizations to handle new business strategies. The learning organization is orientated to cultural reform of organizational attitudes and practices surrounding knowledge. The organization focuses on the way people think and learn competencies, rather than on the way they organize their knowledge. The learning organization values team learning through the exchange of tacit knowledge. In this way the learning organization manages the risk of the loss of key employees by mitigating

knowledge monopolies and developing team knowledge. The ultimate objective of team learning is to improve the levels of organizational innovation.

3.2 The Knowledge Library

The knowledge library "approach to KM focuses on enhancing the organisations ability to manage new projects or processes" [20]. As explained by Borghoff and Pareschi [5] this approach is best suited for environments in which the basic stimuli are not subject to dynamic and complex change. Typically the objective of the initiative is to establish a corporate knowledge base, capital structure, for the capture and dissemination of best practices and project related knowledge. The function of the database is to share insights gleaned from the organization's previous experiences, in the hope that they may find application in future projects in an effort to avoid reinventing the wheel. Projects, processes and case studies are documented with relevant supporting documents. Management challenges in this KM approach are the classification and organization of knowledge/information in a fashion that matches the work needs of people with knowledge held by others and encouraging the use of the knowledge base.

4 Knowledge Management Approaches

According to the organization objectives, two knowledge management approaches appeared: the former considers the informational resources as the experiment of the organization ("information oriented"), while the latter becomes essentially attached to the knowledge ("knowledge oriented"). These two approaches distinguish themselves by the nuance between information and knowledge. Indeed, if basic stages are common (Acquisition/Generation, Memorization, Treatment and Communication), the objects that they manipulate are as for them different [10]. These differences have significant ramifications for the elaborated tools: those of IS, for example, don't include the phases of knowledge extraction near the actors of the company, like in the case of the knowledge management, without forgetting the knowledge obtained by the practice which one generally doesn't find in documents, as well as the reasoning mechanisms of the actors that are not taken in account. However, the experiment is a significant type of knowledge that is not in the documentary mass of the company.

4.1 Information Oriented Approach

In this approach, we consider that the documents constitute knowledge [26] or that the information management is a source of experiment of the company [21]. In

this sense, some company's memories projects were essentially interested in the existing documents in the company of which it is going to be about organizing the access and the exploitation. Among the tools conceived in this setting, it is possible to distinguish:

- Those that rest on the documents themselves (under all their forms, papers, electronic ...) as it is the case in DIADEME system [26] developed for the direction of research at EDF. This tool is essentially based on the existing documents and those generated by this service: technical reports, congress articles, experiment reports in paper, audio or video format. These documents are neither transformed nor modeled. The tool permits storage and indexing so that they are easily accessible. Several methods of interrogation exist, however keyword search is most common.
- Those that rest on the representation of these documents, these tools will permit modification in the way documents are reached [10]. These representations authorize more advanced means of exploitation. To alleviate the formalization phase that can be time-consuming and expensive (from the mobilized personnel point of view) the designers tend to automate this task. These representations are not intended for the users, who would have to assimilate the formalism of it, but allow the research's systems that use them to have a finer picture of the content of the document than that given by simple key words. In Knowledge Organizer of [21] the user browses a semantic network that categorizes different references to available documents visually. The nodes of the network include some basic information regarding the document: the title, the date of last update, the author's number identifier, the address URL of the document. The ties of the network comprise a label that describes the nature of the relation between two documents. In other cases, the representations of the documents are built to be exploited in an automatic way by Workflow's tools in quest of information.

The oriented information approach for knowledge management has an essential advantage that can influence the choice of an experiment management strategy: simplicity of implementation and low cost. Resting on the existing documentation basis, it doesn't require a knowledge extraction phase. Besides, it can rely on the available tools within the company as those already integrated within the IS. However, it has the disadvantage of exploiting, for experiment transfer, documents that have not necessarily been produced accordingly (management reports, technical documentation, etc.) [22] and it sometimes cuts down to only one type of document (internal and external mails).

4.2 Knowledge Oriented Approach

The knowledge-oriented approach tends to model expert knowledge in order to build automatic problem resolution tools in order to protect the experience gained

by an organization. Declarative and procedural knowledge transcribed in the form of rules, facts, cases, procedures of reasoning will translate a part of the experience acquired by the staff of the organization. Several works have been given in this approach and a significant number of methods were elaborated and standardized.

This knowledge management and capitalization approach has considerable advantages particularly in the capacity of work in a global manner [10]. However, this capacity is at the origin of the increased delays and of the costs of setting in work and update of the systems.

5 Conclusion

In the age of international markets and increased worldwide competition, many enterprises are looking for new ways to gain and maintain competitive advantage. One way is the use of their intellectual capital. Since most companies have access to the same processes, cost management techniques and material management systems, the only thing that separates them is the knowledge held within each company. Research conducted by Kock and al [18] has shown that, in a typical company, approximately ninety per cent of all exchange processes involve the exchanging of data. Approximately seventy-five percent of this data is classed as information or knowledge. This percentage is set to rise, due to the advances in expert knowledge-based technologies and an increase in their use.

The management of this intellectual capital comes true by a complete loop of identification, structuring, modeling, and setting in work of capitalization techniques and reuse of knowledge in the organization. In order to be profitable, this loop must be efficiently managed, being analyzed and subject to management rules. It must not only lean on individual knowledge but on the whole organization's knowledge, and also includes structuring, storage and sharing tools.

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